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ABSTRACT

A discussion of two aspects of Hindi phonology, schwa deletion and vowel nasalization, compares two theories concerning the processes behind these phenomena. A non-linear analysis is compared with a more traditional, linear notation. Results indicate that in most cases, both sets of rules work equally well but in some, the linear explanation is less "ad hoc" and more insightful. Certain assumptions inherent in the non-linear analysis are also called into question. (MSE)

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Schwa Deletion and Vowel Nasalization in Hindi by Linear and Non-Linear Routes: A Reassessment

Manjari Ohala

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Schwa Deletion and Vowel Nasalization in Hindi by Linear and Non-Linear Routes: A Reassessment.

Manjari Ohala

San Jose State University

Introduction

Recently there has been a virtual explosion of works in the area of non-linear phonology, many of them consisting of a reworking in the new non-linear framework of familiar problems previously handled by linear phonology //Ftnt 1//. One of these is D'Souza's (1985) pioneering paper on Hindi in which she offers a non-linear account of schwa deletion and vowel nasalization which she characterizes as "simpler...more elegant...more insightful...and more illuminating" than linear accounts given by others, including myself (Ohala 1972, 1983). In this paper I will try to show that for the majority of cases my rules and hers work equally well,and in some cases my rule is less ad hoc and more insightful. Moreover, her analysis rests on certain unstated assumptions regarding some of the most controversial and largely unresolved issues in the recent history of phonology: the notion of simplicity and the evaluation metric, abstract underlying forms, what constitutes explanation in phonology, the psychological reality of posited phonological constructs. First a review of the Hindi data as it applies to schwa deletion:

Schwa Deletion

Hindi has many words such as those in (1) where we see the schwa is deleted in the environment given in (2).

(1)

a.	[nəmək]	salt	[nəmkin]	salty	(native)
	[pIčak]	squeeze	[pIčka]	squeezed	(native)
	[upər]	top	[upri]	pertaining to the top	(native)
b.	[nəzər]	vision	[nəzrɪ]	visual	(PA)
	[nɔkər]	servant	[nɔkri]	job	(PA)
	[nəgər]	city	[nagrIk]	citizen	(Skt)
	[danəw]	demon	[danwɪ]	demonish	(Skt)
	[šitəl]	cool	[šitla]	cool, name of goddess, girl's name	(Skt)
c.	[sərəl]	guileless	[sərla]	guileless, girl's name	(Skt)
	[sUrəb^{h}ɪ]	~	[sUrb^{h}ɪ]	sweet-smelling air, girl's name	(Skt)

(2) ə --→ 0 / VC___CV

As we can see the rule applies both morpheme internally (1.c) and across morpheme boundaries when suffixes are added (1.a and 1.b). We also see that the rule applies to both native and non-native vocabulary. However, while the schwa is always deleted in such native words, in the loans it is not deleted in the derived forms by all speakers in all styles of speaking. In the case of Sanskrit loans, e.g., [sərla], the schwa is deleted only if the word is familiar, otherwise it is retained. Thus when used as a proper name [sərla] etc would always have the schwa deleted. However when not used as a name, some speakers may retain the schwa when speaking formally. On the basis of data such as this in Ohala 1983 I had isolated the following sociolinguistic deter-

minants of schwa deletion:

(a) If the word is a Sanskrit or Urdu loan, speakers aspiring to the most prestigious pronunciation will render these words as they were rendered in the original language.

(b) schwas tend to be deleted in casual style of speaking and retained in formal style, other things being equal. Thus in [sʊrəbʰɪ] etc. in formal style, or careful speech as in reading, some retain the schwa and others dont. Or the same speaker varies depending on the style of speaking.

(c) schwas tend to be deleted in faster tempo of speaking.

There are also words such as those in (3):

(3)	[jəŋgəl]	forest	[jəŋgli]	wild
	[bɪstər]	bedding	[bɪstra]	bedding
	[dərʁən]	philosophy	[darʁnīk]	philosopher
	[pʊn̥dərɪk]	~	[pʊn̥drɪk]	white lotus
	[mən̄jəri]	~	[mən̄jri]	tiny cluster of flowers, girl's name
	[kadəmbəri]	~	[kadəmbri]	a novel, girl's name

Here the schwa is deleted in spite of a preceding cluster and the rule given so far will have to be modified to account for these. Additional forms such as those in (4) show that the rule cannot be modified to simply delete the schwa if up to two consonants precede.

(4) [mətləb] interest [mətləbɪ] selfish *[mətlbɪ]

[kəsrət]	exercise	[kəsrəti]	pertaining to exercise	*[kəsrti]
[ədrək]	ginger	[ədrəkõ]	gingers (obl)	*[ədrkõ]

The forms in (5) give us a clue to what might be going on:

(5)	[adət]	habit	[adətẽ]	habits	*[adtẽ]
	[mUsibət]	difficulty	[mUsibətõ]	difficulties (obl)	*[mUsıbtõ]
	[ləkʂmən]	a god, boys's name	[ləkʂmənõ]	ditto (pl)	*[ləkʂmnõ]

The schwa does not delete if the resulting cluster would violate phonotactic constraints. In the case of the last word, a 4 consonant cluster would result and Hindi does not permit 4 consonant clusters.

The schwa is never deleted if a cluster follows as can be seen from (6):

(6)	[pələnɡ]	bed	[pələnɡõ]	beds (obl)	*[pələnɡõ]
	[pəkʰəṇḍ]	hypocrisy	[pakʰəṇḍi]	hypocrite	*[pakʰndı]

Finally, we see from the words in (7) that the schwa is not deleted if there is a morpheme boundary to the left. In other words if the schwa is in the first syllable of a morpheme .

(7)	kəla + wət + i	[kəlawətı]	one who knows the arts, girl's name	*[kəlawtı]
	ʂəmpa + kəlı	[ʂəmpakəlı]	Michelia champacca, girl's name	*[ʂəmpaklı]

On rather meagre evidence, I had also proposed that the schwa

deletion rule applies from right-to-left.

To account for all of the above facts the schwa deletion rule I gave was as in (8):

(8) ə --→ Ø / VC ____CV $\left\{ \begin{bmatrix} +\text{loan} \\ +\text{casual speech} \end{bmatrix} \right\}$ [+normal tempo]

Condition 1: There may be no morpheme boundary in the environment to the left.

Condition 2: The output of the rule will not violate the sequential constraints of Hindi.

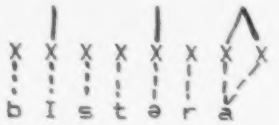
Convention: The rule applies from right to left.

D'Souza considers the rule in (8) to be rather complex and with "...arbitrary conditions" and offers a non-linear alternative. Before considering her rules a brief description of the conventions she follows may be useful.

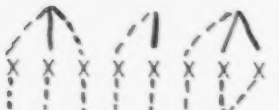
D'Souza follows Archangeli (1984) and uses the unlabelled X slots in the core skeleton. In underlying representations (UR) syllable heads are indicated by a vertical line linked to an X slot. All other elements are unlinked. Universal syllabification rules apply first. Solid lines in the notation indicate prespecified items in the UR and broken lines show what is incorporated by rule. Thus, the onset and coda rules yield syllabification by the 'onset first' principle (Clements and Keyser 1983) proposed as a universal. By this principle consonants are assigned to a following vowel nucleus as long as the phonotactic constraints of the language in question are not violated. Remaining consonants are assigned to the coda of preceding

vowels.//Ftnt 2//

A word like [bIstəra] would create syllables as follows:

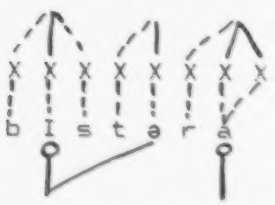


core skeleton



by core syllabification

Then foot construction takes place as specified in (9) below.



Since the second syllable has a light rime, the foot has a weak branch. Rule (9) states that the schwa is desyllabified (i.e., deleted) if it is on a weak branch of a foot (formalized by severing the association line marking it as syllable head). The phonetic form without the schwa results, i.e., [bIstra].

D'Souza's rules for Hindi schwa deletion are the following:

(9) Universal Rules

1. Core syllabification obtained by the onset rule and the coda rule.

Hindi-specific Rules

2. Foot rule: build "left dominant quantity sensitive binary feet beginning at the left edge of the word."

3. Schwa desyllabification rule:

4. Schwa reinstatement rule:

5. Rules of extended syllabification:

Prerequisite: Rule ordering

Condition: If cluster violates phonotactic constraints, schwa reinstatement must apply. "Restrictions on permissible onset and coda clusters are extremely stringent in this language."

Assumption: Every morpheme initial syllable is the head of a foot.

For the majority of cases, i.e., words such as [pIčək] [pIčka], my rule and hers work equally well because my formalization, ə → Ø /VC___CV is the linear equivalent of saying the schwa has to be in a weak branch of a foot in order to delete: it is a notational variant of what D'Souza expresses in hers. (My rule also assumes her syllabification rules.) Granted there may be cases where linear and non-linear notations do different things, as in the treatment of C + glide or liquid clusters in the English stress rules (Hayes 1981), but such crucial

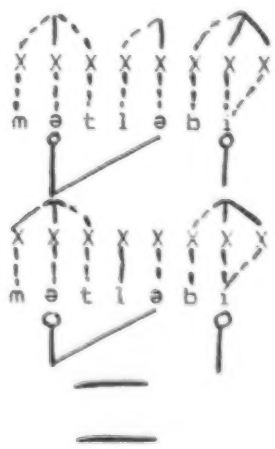
differences do not arise in the case of schwa deletion in Hindi.

Another instance where the two formalisms are similar may be seen in condition 1 of my rule. Although this condition is admittedly ad hoc, it is no more so than the one D'Souza invents for the same purpose, namely, that every morpheme initial syllable is the head of a foot. This is not an explanation. Both versions amount to giving special status to the first syllable of a morpheme. Neither one explains why it has this special status for this rule.

In many other cases my rule is more insightful and accounts for the facts better. Condition 2 of my rule not only accounts for non-deletion of schwas in words such as [mətlə b] [mətləbi] which involve preceding clusters, but also in the case of /adət+ẽ/ 'habit + plural' where we don't get *[adtẽ]. D'Souza not only has to invoke the same phonotactic constraint but also complicates her account by requiring a schwa reinstatement rule to put the schwa back where its deletion leads to phonotactic violations.

An example of her rules at work is given in (10):

(10)

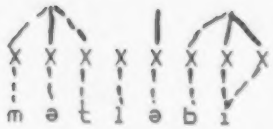


syllabification and foot construction

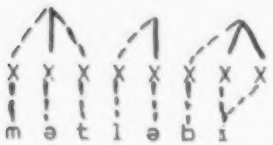
schwa desyllabification

core syllabification

extended syllabification



schwa reinstatement

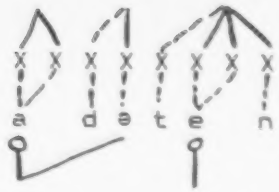


core syllabification

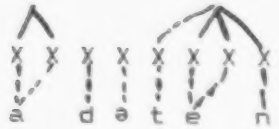
Phonetic representation

Here the core syllabification cannot take care of the stranded 'l' since the onset and coda positions are already filled. According to D'Souza, Hindi also has rules of extended syllabification (given in (9)) for assigning additional consonants to the onset or coda. However, extended syllabification cannot apply because "Restrictions on permissible onset and coda are extremely restricted in this language". Thus schwa reinstatement applies--notice that it is needed in just those cases where schwa deletion would lead to an impermissible cluster. My rules were able to account for these same facts with just this phonotactic constraint without all the gymnastics of deleting and reinstating schwas. Moreover, I don't see how D'Souza's rules will account for the non-deletion of the schwa in [adə̃tẽ] because the 'd' would be assigned to the first syllable as a coda by core syllabification after the schwa desyllabification rule has applied as shown in (11).

(11)



schwa desyllabification



core syllabification

*[adtẽ] predicted phonetic representation

Finally, D'Souza's analysis does not account for the sociolinguistically determined variability in the application of the rule. (That is, the factors listed in (8)). Such variation does not represent dialect variation as D'Souza mistakenly assumes. She claims that speakers who delete the schwa when a cluster precedes belong to a different dialect and she tries to account for the dialect differences by saying that in the dialect where schwa does not delete after clusters, the extended syllabification rule applies <u>after</u> schwa reinstatement whereas in the one where schwa deletes in spite of preceding clusters, the extended syllabification rule applies <u>before</u> schwa reinstatement. However, the fact is the <u>same</u> speaker deletes the schwa depending on these sociolinguistic variables. Thus the elaborate rule ordering schemas are entirely unnecessary.

We see that the non-linear account of Hindi schwa deletion is not more "insightful" and explanatory than the linear one I

presented in Ohala '83.

Vowel Nasalization

D'Souza follows Narang and Becker (1971) and advocates deriving all nasalized vowels from underlying oral vowel + nasal sequences (i.e. posits abstract underlying forms). In the case of treating vowel nasalization and its interaction with schwa deletion, she proposes an elaborate non-linear solution to a non-problem. The problem associated with accounting for alternations such as those in (12) disappears when one treats them as they are actually pronounced as in (13):

(12)	[ãgən]	courtyard	[ãgənõ]	courtyards (obl)
(13)	[ãŋgən]		[ãŋgnõ]	

Figures 1a to 1d are spectrograms which clearly show that such words have a nasal present phonetically. First, in order to show that [ãŋgən] has a homorganic nasal it is contrasted with [ãk] 'sign' in Fig. 1a where we can see there is no trace of a nasal consonant before the [k]. Similar spectrograms for words involving the dental nasal+stop sequences were given in Ohala 1983. Since D'Souza refers to this work of mine it is unclear to me why, without any discussion, she dismisses such data and reverts to the earlier Narang and Becker analysis which lacked evidence for the claim that the pronunciation of such words has no homorganic nasal before the stop. Her goal in eliminating nasalized vowels at the underlying level is to "reduce the phonemic inventory of the language significantly". But she does not discuss why this is desirable. Even if this were desirable from the point of view of the evaluation metric, the cost of

adding the rules she posits would have to be taken into account. Moreover, the notion of the evaluation metric itself is controversial and needs to be justified. There has never been a shred of evidence that such reduction of segment inventory has any significance for native speakers.

Narang and Becker claimed that the schwa does not delete in words such [ãgənõ] 'courtyards' (their transcription--see (13) for the correct one) and that this shows that a nasalized vowel actually acts as a VN sequence and thus the NC cluster preceding the schwa prevents its deletion. D'Souza follows Narang and Becker in this analysis. However, as can be clearly seen from the spectrograms in Figures 1b-d, the schwa is deleted in such words. D'Souza does admit the possibility of the schwa in such words deleting for some speakers, but again attributes this to a dialect difference. Once again, the deletion or non-deletion of schwa in such words is not a dialect difference; the same speaker may vary depending on whether the word is in isolation or in a sentence and depending on the sociolinguistic factors I have already mentioned. We see in the spectrograms in Fig. 1c and d for the word [ãŋgnõ] the same speaker retained a schwa in this particular rendition of the word in isolation but deleted it in the sentence frame. Interestingly, we also notice in the spectrograms that there is no trace of a velar stop present in these words. This becomes clear from an examination of the narrow band spectrograms given in 1b-d where we do not see at the points marked by the arrows any F0 perturbations which we would expect during a voiced stop.

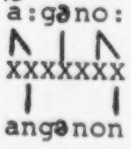
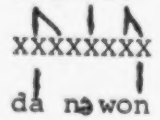
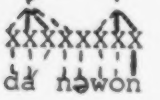
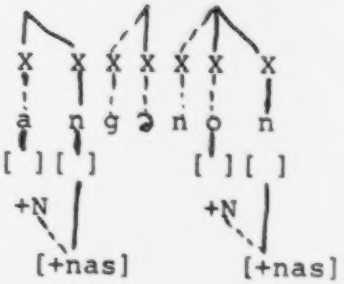
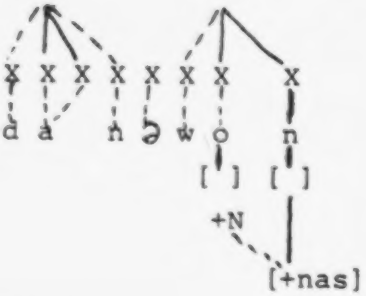
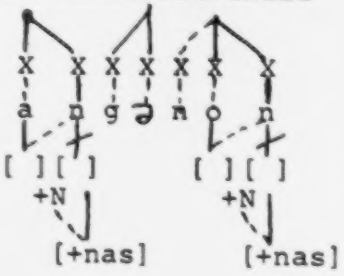
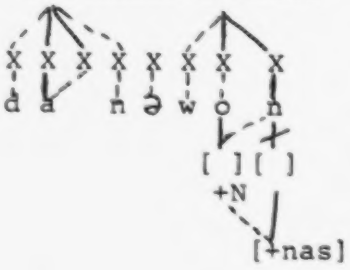
There are additional problems with D Souza's analysis: she

proposes to account for vowel nasalization in Hindi by first of all assuming long nasalized vowels are underlyingly short oral vowels followed by a nasal. There is absolutely no evidence for such abstract underlying forms. She assumes underlying representations such as those in (14):

(14)

That is, the nasal consonant in the coda has to be linked to the X slot not by general rules but in the underlying representation. This is because only such nasal consonants will spread to the vowel, eventually delinking (i.e. deleting) and thus not showing up at the phonetic level. A sample derivation is given in (15):

(15)

	ã:gənõ: 'courtyard'	da:nwõ: 'demon'
UR		
syllabification and foot const.		
schwa desyll.		
core syllab.	-------	
schwa reinst.		———————
core syllab.		--------
nasal spread		
core syllab.	----------	----------
vowel spread		
core syllable	----------	----------
PR	ã:gənõ:	da:nwõ:

A number of points can be made here:

(a) D'Souza seems to claim that the first vowel of [danwõ] is not nasalized. There is no evidence for this. In Hindi (as in many other languages) there is anticipatory nasalization on vowels before nasals as can be seen in the nasograph data given in Ohala 1983:105 for the word [kãn] 'ear' which exhibited velic opening in anticipation of the nasal starting almost immediately after the release of the [k]. The correct form would be [dãnwõ] and D'Souza's rules as given would not work.

(b) Having the nasal consonant in the coda linked to the X slot in the underlying representation in just those cases where the nasal has to be finally deleted is the equivalent of what has been called a diacritic use of a phonological feature. This is transparently ad hoc.

(c) As I mentioned, D'Souza posits underlying short vowels for phonetic long nasalized vowels//Ftnt 3// and then has a 'vowel spread' rule (applying after 'nasal spread') so as to obtain the phonetic long nasalized vowels. For a pair such as that in (16A) she would posit an underlying representation such as in (16B):

(16) a. Phonetic: [sĩɛ̃] irrigate [sĩɛ̃] be irrigated

b. UR: /sĩnɛ̃/

From the UR in (16b) I can see how she would obtain [sĩɛ̃] but not [sĩɛ̃]. She would have to mark such forms specially as [-vowel spread], but that would be ad hoc. Moreover for pairs such as those in (17) I presume she would not want to claim that the

(17) [bə̃nd^h] be tied [bə̃nd^h] tie *[bə̃d^h]

phonetic form contains no nasal. But how then will nasal spread and vowel spread both be prevented from applying to the UR of words such as [bə̃ndh]?

It is also not clear how she would account for words such as that given in (18) which has no long vowel counterpart:

(18) [d̪ə̃ŋk] sting *[d̪ə̃k]

We see that D'Souza's analysis of nasalized vowels of Hindi has many flaws and cannot be used in support of the claim that a non-linear account of vowel nasalization is better than a linear one.

Conclusion

Although I do not claim that my analysis is profound or the last word on these aspects of Hindi phonology, I hope to have demonstrated that it has not been improved upon by D'Souza's non-linear analysis. This paper is not intended as an indictment of non-linear phonology, which indeed has demonstrated its usefulness for many phonological problems, especially those concerning prosodic phenomenon. Rather it is intended to sound a note of caution: rewriting phonological data in a new notation does not automatically yield an analysis which is more insightful, simpler, etc. and certainly not explanatory. Insight and explanation are not come by easily; in the case of phonology it will inevitably require looking at how the behavior of speech sounds follows from a consideration of their physical phonetic structure and their psychological structure. To date neither traditional linear nor the new non-linear notation can seriously lay claim to having achieved this.

Footnotes

1. An earlier version of this paper was delivered at the 8th South Asian Languages Analysis Roundtable held at the University of Illinois, Champaign-Urbana, 29-31 May 1986. I am grateful to John Ohala for his comments and also for making available to me the facilities of the Phonology Laboratory at University of California, Berkeley. I also thank Debbie Feder for her help in making the spectrograms.
2. Additional details of this principle are not given here; the reader is referred to standard works on non-linear phonology such as Clements and Keyser (1983).
3. This analysis is not original with D'Souza; it was first proposed by Srivastava 1969. In Ohala 1983 I discussed a number of problems associated with such an analysis.

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